PROVISIONAL INTELLIGENCE REPORT

CIVIL CONSUMPTION OF PETROLEUM PRODUCTS IN RUMANIA 1950-55

CIA/RR PR-132
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CIA/RR PR-132

(ORR Project 25.693)

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FOREWORD

The purpose of this report is to develop estimates of civil consumption of petroleum products in Rumania for the 1950-55 period by aggregating the data on consumption by each class of consumers. Existing estimates have been derived by the subtraction of aggregates -- that is, by subtracting "exports plus military consumption" from "production plus imports" -- the remainder representing civil consumption. This method is unsatisfactory because the full usefulness of the supply-demand balance can be realized only when both the supply and demand components are derived independently, each acting as a check on the accuracy of the other.

For analytical purposes, this report divides the petroleum-consuming economy of Rumania into seven sectors: motor transport, rail transport, air transport, water transport, agriculture, households, and industry.

Only petroleum products in major use by the civil economy are treated. These are gasoline, kerosine, diesel fuel oil, residual fuel oil, and lubricants. Natural gas, which is not a refined product, is excluded, as are three minor products -- petroleum asphalt, petroleum coke, and liquefied petroleum gases. These last three products comprised only 3 percent of domestic consumption of petroleum products in 1946-47.

The main difficulty encountered in deriving the estimates was, of course, the lack of official statistics. Only three figures on consumption were found useful -- the consumption of kerosine in 1950, the consumption of motor gasoline in 1947, and the consumption of fuel oil by the Rumanian railroads in 1946. The lack of official figures necessitated the extensive use of statistical apparatus in certain sections of the report, and the errors inherent in such methodology must be recognized. The probable range of error in the estimate for each petroleum-consuming sector of the economy is given in the text.

These statistical errors doubtless will be reduced through future collection and analytical efforts. This initial effort to estimate the civil consumption of petroleum in a European Satellite may serve as an incentive toward further study of this problem and as a guide in directing efforts to fill the major gaps in our present intelligence coverage.

This report has been coordinated within CIA but not with the other IAC agencies.

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CIVIL CONSUMPTION OF PETROLEUM PRODUCTS IN RUMANIA 1950-55*

Summary and Conclusions

Civil consumption of petroleum products in Rumania increased from about 1.6 million metric tons** in 1950 to about 2.6 million tons in 1955, an increase of 62.5 percent. In 1955 the industrial sector of the civil economy was the largest user of petroleum products, consuming about 789,000 tons. Rail transport consumed 758,000 tons; households, 535,000 tons; motor transport, 325,000 tons; water transport, 77,000 tons; agriculture, 80,000 tons; and air transport, 3,000 tons. The increase in civil consumption of petroleum products in Rumania is primarily the result of growing industrialization and the increasing mechanization of agriculture.

In terms of percentage increase in consumption of petroleum products during the 1950-55 period, agriculture made the greatest gain -- from 27,000 tons in 1950 to 80,000 tons in 1955, an increase of about 200 percent. During the 5-year period the household sector showed the second largest percentage increase, almost 150 percent, and the motor transport sector had a percentage increase of almost 100 percent.

In 1955 the civil economy of Rumania consumed 1,505,000 tons of residuals, 535,000 tons of kerosine, 328,000 tons of gasoline, 97,000 tons of diesel fuel, and 100,000 tons of lubricants. Over the 1950-55 period the percentage increase in consumption was greatest for kerosine -- almost 150 percent -- and second largest for gasoline -- about 100 percent.

Although consumption of petroleum products by the civil economy in Rumania has increased substantially on a quantitative basis during the 1950-55 period, the annual rate of increase has declined. Total

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 October 1955.

** Tonnages throughout this report are given in metric tons.

consumption by the civil economy in 1951 rose 10.8 percent above that of 1950, but consumption in 1955 increased only 8.1 percent above that of 1954. A correspondingly smaller increase is likely in 1956.

The total amount of petroleum products consumed annually by the civil economy in Rumania has been a relatively small portion of the indigenous supply and, apparently, is becoming a smaller part each year. Civil consumption in 1950 represented about 34 percent of the total refinery output. That percentage has declined steadily over the 5-year period; and in 1955, civil consumption is estimated at only 27 percent of refinery output.

The relatively low domestic utilization of petroleum products is the result of several factors. Although industry in Rumania has grown steadily during the postwar years, the country is still primarily agricultural -- 80 percent of the population is rural. In addition, the policy of the government is to locate new major fuel-consuming industries near sources of natural gas and to convert established industries -- and households -- from the use of petroleum products to the use of coal, lignite, natural gas, and liquefied petroleum gas.

This policy is dictated, no doubt, by government commitments to increase exports of petroleum products to both Sino-Soviet and Free World markets. In 1952, Rumania exported 4.9 million tons of petroleum products, about 2.5 times the amount consumed by the civil economy; and in 1954, exports rose to 6.9 million tons, about 2.7 times the amount of civil consumption.

It is probable that the government policies on industrialization and exports will not change in the near future and that the general pattern of civil consumption of petroleum products in Rumania will not be substantially altered.

I. Introduction.

This report is concerned exclusively with the civil economy of Rumania. Peacetime military consumption is beyond its scope, and the totals presented do not represent the total consumption of petroleum in Rumania. The data developed in this report will facilitate later analysis of the Rumanian petroleum supply-demand balance, however, and thus will lead to more accurate judgments of Soviet Bloc capabilities for war and of the impact of war on the supply-demand balance.

The civil economy of Rumania is analyzed in terms of seven petroleum-consuming sectors. Consumption of petroleum, by type of product, has been estimated for each sector of the economy for the years 1950-55.

The methodology differs for each of the seven petroleum-consuming sectors of the economy, and details of the various methods are assembled in subsections of Appendix A. Only the general methodology is discussed in the text.

II. Motor Transport.

Estimated consumption of petroleum products in Rumania by motor transport, by type of product, in 1950-55 is shown in Table 1*. In deriving the estimates, use has been made of data on performance of the Rumanian truck fleet, described in terms of millions of ton-kilometers. As a base for the calculations, Rumanian statistics on consumption of gasoline in 1947 are adjusted for consumption by trucks and are applied to the estimated performance by trucks in 1947. An effort is also made to consider the effect of passenger cars and busses on the total consumption of gasoline. The lubricants-to-gasoline consumption ratio is based on Soviet experience.**

Because of the lack of recent primary source material, the probable margin of error inherent in the estimates for motor transport is from minus 10 percent to plus 3 percent.

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* Table 1 follows on p. 4.

** For details of methodology, see Appendix A, Table 13, p. 17, below.

Table 1

Estimated Consumption of Petroleum Products in Rumania by Motor Transport, by Type of Product a/ 1950-55

	Thousand Metric Tons		
Year	Gasoline b/	Lubricants	Total
1950	167	8	175
1951	195	10	205
1952	226	11	237
1953	253	13	266
1954	281	14	295
1955	309	15	325 c/

a. Data have been taken from Appendix A, Table 13, p. 17, below.
b. Data on diesel units are too fragmentary to permit estimating consumption of diesel fuel. Its use probably is negligible.
c. The total is derived from unrounded figures and is not the sum of the rounded data shown.

III. Rail Transport.

Estimated consumption of petroleum products in Rumania by rail transport, by type of product, in 1950-55 is shown in Table 2.* The data have been derived from estimates of the annual increases in the distances which freight has been hauled. These estimates are based on a comparative analysis of statistics on daily car loadings and freight car park. Because the figure for consumption of fuel in 1946, which is used as a base, includes transport of passengers as well as freight and railroad stock, all three categories are included in the estimates for subsequent years. No substantial change in the ratio of coal-fired locomotives to oil-fired locomotives has been reported since 1946, and there have been no reports of the acquisition of any diesel units.

* Table 2 follows on p. 5.

Table 2

Estimated Consumption of Petroleum Products in Rumania by Rail Transport, by Type of Product a/ 1950-55

	Thousand Metric Tons		
Year	Residual Fuel Oil. b/	Lubricants	Total
1950	506	56	562
1951	567	63	630
1952	605	67	672
1953	640	71	711
1954	667	74	741
1955	682	76	758

a. Data have been taken from Appendix A, Table 14, p. 18, below.
b. Only one diesel unit has been reported for 1951, and consumption of diesel fuel is considered negligible.

It is believed that the estimates for rail transport are accurate within a range of error of plus 20 percent.*

IV. Civil Air Transport.

Estimated consumption of petroleum products in Rumania by civil air transport, by type of product, in 1950-55 is shown in Table 3.** The estimates are based solely on Rumanian civil airline flights, with attendant handling losses and ground consumption included. The few mere mentions in Rumanian radio broadcasts of air-ambulance service, aerial crop dusting, and other miscellaneous civil air operations offer no basis for assuming that these activities are significant consumers of petroleum in present-day Rumania, and in these estimates no consideration is given to those activities.

* For details of the computations, see Appendix A, Table 14, p. 18, below.
** Table 3 follows on p. 6.

Annual consumption of aviation gasoline in the 1950-55 period is estimated by applying a consumption rate per hour to estimated total hours flown during each year. On the basis of US experience, consumption of lubricants is estimated at a percentage of total gasoline consumed.*

It is probable that the range of error in the estimates is no greater than minus 20 percent.

Table 3

Estimated Consumption of Petroleum Products in Rumania by Civil Air Transport, by Type of Product a/ 1950-55

	Thousand Metric Tons		
Year	Gasoline	Lubricants	Total
1950	2.38	0.05	2.43
1951	2.44	0.05	2.49
1952	2.50	0.05	2.55
1953	2.56	0.05	2.61
1954	2.62	0.05	2.67
1955	2.68	0.05	2.73

a. Data have been taken from Appendix A, Table 16, p. 22, below.

V. Water Transport.

Estimated consumption of petroleum products in Rumania by water transport, by type of product, in 1950-55 is shown in Table 4.** The estimates are based on separate analyses of the inland and ocean

* For details of methodology, see Appendix A, Tables 15 and 16, pp. 21 and 22, below.
** Table 4 follows on p. 7.

fleets. The horsepower of the petroleum-fueled units of each fleet and the average times under way and at anchor are estimated, and thus the horsepower-hours in use are derived. The application of fuel-consumption factors per horsepower-hour under way and at anchor yields estimates of consumption for each type of petroleum product. Estimates of consumption of lubricants are obtained by applying a consumption factor to the annual serviceable horsepower of all vessels in both fleets.*

The margin of error for petroleum fuels and lubricants is estimated at plus or minus 25 percent. This relatively large margin of error is not considered significant, however, because of the relatively small consumption in this category.

Table 4

Estimated Consumption of Petroleum Products in Rumania by Water Transport, by Type of Product a/ 1950-55

Thousand Metric Tons

Year	Diesel Fuel	Residual Fuel Oil	Lubricants	Total
1950	17	50	2	69
1951	21	50	2	73
1952	23	50	2	75
1953	23	50	2	75
1954	24	50	2	76
1955	25	50	2	77

a. Data have been taken from Appendix A, Tables 19 and 22, pp. 19 and 33, respectively, below.

* For details of methodology, see Appendix A, Tables 17 through 22, pp. 23 through 33, below.

VI. Agriculture.

Estimated consumption of petroleum products in Rumania by agriculture, by type of product, in 1950-55 is shown in Table 5.

Annual consumption of petroleum products by agricultural tractors is estimated by multiplying the consumption of diesel fuel (the only tractor fuel in Rumania except gasoline for starting diesel engines) per hour of average operation by the number of tractor-hours worked per year. Both the size of the effective tractor park and the effect on consumption of fuel of different types of tractor work are critical considerations. A lubricants-to-fuel consumption ratio is used for estimating consumption of lubricants.

Table 5

Estimated Consumption of Petroleum Products in Rumania by Agriculture, by Type of Product a/
1950-55

Thousand Metric Tons

Year	Gasoline	Diesel Fuel	Lubricants	Total
1950	1	25	1	27
1951	2	31	2	35
1952	3	39	2	44
1953	5	48	3	56
1954	8	55	3	67 b/
1955	16	60	4	80

a. Data have been compiled from Appendix A, Table 26, p. 39, below.
b. The total is derived from unrounded figures and is not the sum of the rounded data shown.

Consumption of petroleum products by grain combines (Rumania uses only the imported S-4 type) is estimated by multiplying an hourly

rate of fuel consumption by the hours of combine use per year. Consumption of lubricants is based on its relationship to consumption of fuel.*

Estimates for hours worked may be in error by minus 10 percent, and estimates of fuel consumption rates may be in error by plus 5 percent. The cumulative effect on total consumption of fuel probably is a range of error of about minus 5 percent.

VII. Households.

Estimated consumption of kerosine in Rumania by households in 1950-55 is shown in Table 6.

Table 6

Estimated Consumption of Kerosine in Rumania by Households a/ 1950-55

Thousand Metric Tons

Year	Kerosine	Year	Kerosine
1950	220	1953	355
1951	236	1954	436
1952	290	1955	535

a. Data have been taken from Appendix A, Table 27, p. 40, below.

Consumption of petroleum products by Rumanian households is believed to consist almost entirely of kerosine, used for heating, lighting, and cooking. Unknown quantities of bottled gas are produced in Rumania and to some degree may be displacing kerosine for cooking. The use of

* For details of the computations, see Appendix A, Tables 23 through 26, pp. 34 through 39, below.

oil for space heating is considered negligible. By governmental directives, oil has been largely displaced by coal, wood, and gas.

Estimates are derived by projection of Rumanian statistics on consumption of kerosine, and probably are accurate within a range of error of plus or minus 5 percent.*

VIII. Industry.

Estimated consumption of petroleum products in Rumania by industry, by type of product, in 1950-55 is shown in Table 7. The estimates are based on the premise that, in the predominantly agricultural economy of Rumania, four main industrial groups account for by far the greater part of petroleum consumption by industry.**

Table 7

Estimated Consumption of Petroleum Products in Rumania by Industry, by Type of Product 1950-55

Thousand Metric Tons

Year	Diesel Fuel	Residuals	Lubricants	Total
1950	16	550	4	570
1951	16	601	4	620 b/
1952	15	653	4	672
1953	14	698	4	716
1954	13	740	3	756
1955	12	773	3	789 b/

a. Data have been taken from Appendix A, Table 31, p. 45, below.
b. The total is derived from unrounded figures and is not the sum of the rounded data shown.

* For details of methodology, see Appendix A, Table 27, p. 40, below.
** For details of methodology, see Appendix A, p. 41, below.

Because various constant factors were necessary in estimating consumption in several industrial processes where the factors are quite variable, and because the rate of conversion to gas and coal from fuel oil in the steel and electric power industries is indeterminable, it is possible that the estimates of consumption by the industrial sector may be as much as 30 percent too high.

IX. The Petroleum-Consuming Economy.

Estimated civil consumption of petroleum products in Rumania, by consuming sector, in 1950-55 is shown in Table 8, and an index of estimated civil consumption of petroleum products in Rumania, by consuming sector, in 1950-55 is shown in Table 9.* The gradual rise in

Table 8

Estimated Civil Consumption of Petroleum Products in Rumania, by Consuming Sector a/ 1950-55

Thousand Metric Tons

Consuming Sector	1950	1951	1952	1953	1954	1955
Motor transport	175	205	237	266	295	325
Rail transport	562	630	672	711	741	758
Air transport	2	2	3	3	3	3
Water transport	69	73	75	75	76	77
Agriculture	27	35	44	56	67	80
Household	220	236	290	355	436	535
Industry	570	620	672	716	756	789
Total	1,625	1,801	1,993	2,183	2,374	2,565

a. Data have been compiled from Tables 1 through 7, pp. 4 through 10, above.

* Table 9 follows on p. 12.

Table 9

Index of Estimated Civil Consumption of Petroleum Products in Rumania, by Consuming Sector 1950-55

1950 = 100

Consuming Sector	1950	1951	1952	1953	1954	1955
Motor transport	100	117	135	152	169	186
Rail transport	100	112	120	127	132	135
Air transport	100	100	150	150	150	150
Water transport	100	106	109	110	110	112
Agriculture	100	130	163	207	248	296
Household	100	107	132	161	198	243
Industry	100	109	118	126	133	138
Total	100	111	123	134	146	158

civil consumption is shown in the tables. Among the major consumers, industry and rail transport were the largest, followed by motor transport and households. The first three -- industry, rail, and motor transport -- account for about 80 percent of civil consumption of petroleum in Rumania. Agriculture, although still ranking sixth among the sectors in 1955, has shown the greatest proportionate increase, followed by households and motor transport.

Estimated civil consumption of petroleum products in Rumania, by type of product, in 1950-55 is shown in Table 10,* and an index of estimated civil consumption of petroleum products in Rumania, by type of product, in 1950-55 is shown in Table 11.* The residuals rank first in tonnage consumed for each year of the 1950-55 period. The greatest growth, however, has been in the distillates, as indicated by the index figures for kerosine, gasoline, and diesel

* Tables 10 and 11 follow on p. 13.

Table 10

Estimated Civil Consumption of Petroleum Products in Rumania, by Type of Product a/ 1950-55

Thousand Metric Tons

Product	1950	1951	1952	1953	1954	1955
Gasoline	170	199	231	261	292	328
Kerosine	220	236	290	355	436	535
Diesel fuel	58	68	77	86	92	97
Residuals	1,106	1,217	1,308	1,388	1,457	1,505
Lubricants	71	81	86	93	96	100
Total	1,625	1,801 b/	1,993 b/	2,183	2,373 b/	2,565 b/

a. Data have been compiled from Tables 1 through 7, pp. 4 through 10, above.
b. The total is derived from unrounded figures and is not the sum of the rounded data shown.

Table 11

Index of Estimated Civil Consumption of Petroleum Products in Rumania, by Type of Product 1950-55

1950 = 100

Product	1950	1951	1952	1953	1954	1955
Gasoline	100	117	136	154	172	193
Kerosine	100	107	132	161	198	243
Diesel fuel	100	117	133	148	159	167
Residuals	100	110	118	125	132	136
Lubricants	100	114	121	131	135	141
Total	100	111	123	134	146	158

fuel. The increased consumption of gasoline is, of course, linked to the greatly increased trucking since 1950; trucks used an estimated 97 percent of all gasoline consumed in 1954 and an estimated 94 percent in 1955. The increase in consumption of diesel fuel is accounted for primarily by agriculture, which used 42 percent of the total diesel fuel consumed in 1950 and 56 percent in 1955.

Estimated civil consumption of petroleum refinery output in Rumania in 1946-47 and 1950-55 is shown in Table 12. The table gives some additional perspective to the over-all pattern of petroleum consumption as presented in this report and shows the ratios of civil consumption to refining output for various years. Even considering the possibility of a range of error in the estimates of consumption, the table shows that the civil economy of Rumania consumes but a small portion of indigenous supplies of petroleum products.

Table 12

Estimated Civil Consumption of Petroleum Refinery Output in Rumania 1946-47 and 1950-55

Year	Refinery Output (Thousand Metric Tons)	Civil Consumption a/ (Thousand Metric Tons)	Percentage of Output Consumed
1946	3,844 b/	1,600 b/	41.6
1947	3,452 b/	1,464 b/	42.4
1950	4,800 c/	1,625	33.9
1951	5,900 c/	1,801	30.5
1952	7,000 c/	1,993	28.5
1953	7,900 c/	2,183	27.6
1954	8,700 c/	2,373	27.3
1955	9,500 c/	2,565	27.0

a. The undocumented estimates are summations of individual sector estimates derived in this report.
b. 1/*
c. 2/

* For serially numbered source references, see Appendix C.

APPENDIX A

METHODOLOGY

No single methodological approach has been possible in arriving at estimates of consumption of petroleum by the seven petroleum-consuming sectors of the civil economy of Rumania. For this reason, each sector is treated in a separate subsection of this appendix, the details of each sector being given in the form of one or more tables. The various general methods may be recapitulated as follows:

1. Motor Transport.

Consumption of gasoline by truck transport in 1947 is determined from Rumanian statistics. Using these basic data, consumption of gasoline in 1950-55 was derived by applying the ratio between estimated truck performance in the 1950-55 period and truck performance in 1947. The additional demands by passenger cars and busses were also measured, although less precisely.*

2. Rail Transport.

Estimates of consumption of fuel by rail transport are based primarily on the increasing distances Rumanian locomotives apparently covered each successive year of the 1950-55 period. The distance factor is developed by a comparative analysis of daily car loadings and working car-park estimates. Consumption by rail transport in 1946 -- a Rumanian figure which includes the transport of freight, passengers, and all rolling stock -- is used as a base. The estimates are also based on two assumptions regarding the composition of the locomotive park.**

3. Civil Air Transport.

Annual consumption of aviation gasoline and aviation lubricants by Rumanian civil air transport is estimated by applying a consumption rate per hour to the estimated number of hours flown each year.***

* See Table 13, p. 17, below.
** See Table 14, p. 18, below.
*** See Tables 15 and 16, pp. 21 and 22, respectively, below.

4. Water Transport.

The Rumanian inland and ocean fleets, both at anchor and under way, were analyzed separately to develop operating hour and operating horsepower totals. To these figures were applied the rates of consumption per horsepower-hour for diesel fuel, residual fuel oil, and marine lubricants, and an estimated total consumption of petroleum products by water transport was derived.*

5. Agriculture.

Estimates of consumption of fuel by agriculture in Rumania were based on an analysis of hours worked by tractors, grain-combines, and other agricultural machines, combined with a study of total working horsepower. To these horsepower-hour totals were applied the rates of fuel consumption per horsepower-hour for each type of equipment, and the results were multiplied by the tractor and combine park.**

6. Households.

Consumption of fuel by Rumanian households is believed to consist almost entirely of kerosine, used for heating, cooking, and lighting. Data on consumption of kerosine in 1950, 1951, and 1955 were obtained from the 1951 State Plan and data for intervening years were derived by interpolation.***

7. Industry.

Estimates of consumption of petroleum by industry were based on the premise that, in the predominantly agricultural economy of Rumania, four industrial groups account for all but a negligible portion of total industrial consumption of petroleum -- petroleum refineries, thermal electric power plants, iron and steel mills, and heavy engineering works. Each of these complexes was analyzed on the basis of petroleum input requirements, which were derived from Rumanian and Soviet experience.****

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* See Tables 17 through 22, pp. 23 through 33, below.
** See Tables 23 through 26, pp. 34 through 39, below.
*** See Table 27, p. 40, below.
**** See Tables 28 through 31, pp. 42 through 45, below.

Table 13

Estimated Consumption of Petroleum Products in Rumania by Motor Transport
1947-55

	1	2	3	4	5	6	7
			Gasoline (Metric Tons)				
Year	Ton-Kilometers a/ (Millions)	Increase in Ton-Kilometers over Previous Year (Percent)	Trucks b/	Passenger Cars and Busses c/	Total d/	Lubricants (5 Percent of Fuel) e/ (Metric Tons)	Total Petroleum f/ (Metric Tons)
1947	19		89,680 g/	16,630 g/	106,310	5,316	111,626
1948	29	152.6	89,680 h/	15,500	105,180	5,259	110,439
1949	39	134.5	120,620	15,500	136,120	6,806	142,926
1950	49	125.6	151,499	15,500	166,999	8,350	175,349
1951	58	118.4	179,375	15,500	194,875	9,744	204,619
1952	68	117.2	210,228	15,500	225,728	11,286	237,014
1953	77	113.2	237,978	15,500	253,478	12,674	266,152
1954	86	111.7	265,821	15,500	281,321	14,066	295,387
1955	95	110.5	293,732	15,500	309,232	15,462	324,694

a. The estimates for 1948-55 are CIA estimates. Complete methodology and documentation for these estimates are available in CIA files. The 1947 figure was obtained by graphic extrapolation of the 1948-55 estimates.

b. Computations for consumption of fuel by trucks are based on the relationship between truck performance (ton-kilometers) in 1947 and the consumption of gasoline by trucks in 1947. The rationale of the correlation is given in footnote h, below. No available evidence indicates any substantial change during the 1947-55 period in the proportion of empty truck runs to loaded trips or in the composition of the truck park with respect to type of fuel used.

c. No statistics on inventory or consumption are available for private cars and busses for the 1948-55 period, and related data are entirely too fragmentary for serious statistical treatment. On the basis of scattered bits of intelligence referring to serious shortages of gasoline, with subsequent rationing and high "free market" prices; to travel restrictions with respect to certain classes of citizens; to some newly acquired busses; and to conversion of Bucharest busses to the use of liquefied petroleum gas, it is concluded that from 1948 to 1953, gasoline consumption by cars and busses ranged between 14,000 and 17,000 tons, a decline from the 1947 figure, which is developed in footnote g, below. The arithmetical average, 15,500 tons, is added for each year following 1947 and is considered an adequate adjustment in view of the insignificance of the amount relative to consumption by trucks.

d. Obtained by adding columns 3 and 4.

e. 3/

f. Obtained by adding columns 5 and 6.

g. Data for 1947 are based on source 4/. The total amount given for the domestic consumption of motorcar gasoline (107,310 tons) is adjusted for consumption by freight trucks by three deductions:

(1) 1,000 tons represents the approximate quantity used in starting the estimated 6,000 German diesel tractors in use in Rumanian agriculture during 1947 (see Table 23, p. 34, below).

(2) 10,630 tons (10 percent of the 106,310 tons remaining after the first deduction) represents consumption of gasoline by the approximately 9,490 passenger cars which operated in Rumania during 1947. This operating inventory figure is based on the reported inventory of 14,600 private cars in Rumania for 1947, 5/ adjusted by a utilization factor of 65 percent. Although 70 percent has been used in converting truck inventories to the number of serviceable trucks, it is probable that even in 1947 less repair and maintenance service was available for private cars than for trucks; 9,490 cars sharing 10,630 tons of gasoline equally, would result, at 12 miles per gallon, in approximately 4,800 miles of private travel a year. This is offered as a check on the plausibility of the amount of the second deduction.

(3) 6,000 tons of gasoline are deducted for approximately 1,400 busses operating in 1947, obtained by multiplying the reported bus inventory 6/ by a utilization factor of 70 percent; 6,000 tons of gasoline would allow each bus about 40 miles per day at 10 miles per gallon.

The above adjustments result in an estimated net consumption of gasoline by approximately 6,720 trucks of 89,680 tons in 1947 -- a reasonable figure.

h. Assuming fully loaded trucks (which is done for 1948-55 but not for 1947, as discussed in the following paragraph), any rise in national truck loadings necessitates added trucks and/or additional hauls by at least some trucks. In any case, the result is greater distance travelled and, by practical axiom for loaded trucks, necessitates a proportionate increase in truck fuel consumed. This proposition is valid because of the nature of ton-kilometer statistics for trucks -- that is, given a constant average length of haul, as is true in the truck ton-kilometer estimates used; and, assuming loaded trucks, any increase in ton-kilometers represents a proportionate increase in tonnage hauled, in number of hauls, and in fuel consumed. This is the basis for computing consumption of gasoline in trucks in 1949-55.

As indicated above, the estimate for 1948 requires an additional adjustment for greater accuracy. It is likely that during 1947, because of the Rumanian industrial slump, trucks did not travel loaded to full capacity, but rather closer to what is here conservatively put at 65 percent. Thus, for example, if the quantity 95 represents performance or tonnage hauled in 1947 -- that is, at 65 percent of full capacity -- then 145 (95 ÷ 65 percent) would represent fully loaded capacity. Taking the position that in 1948 trucks did run fully loaded because of the higher levels of industrial activity, and applying the ton-kilometer statistics for 1947 and 1948 to this example -- 19 million ton-kilometers for 1947 and 29 million for 1948 (which is 19 ÷ 65 percent) -- it is concluded that the entire increase in ton-kilometers from 1947 to 1948 was handled by fuller truck loading and did not result in greater distances hauled or in significantly more fuel consumed than in 1947. The estimates of consumption of gasoline by trucks in 1947 and 1948 are thus shown as identical. The estimates for subsequent years, however, are a function of the increases in ton-kilometers which appear in column 2. For example, the ton-kilometer performance in 1949 showed an increase of 34.5 percent over performance in 1948 (columns 1 and 2); this increase in performance is equated to a corresponding increase in consumption of fuel, for the reasons given in the first paragraph of this footnote. Thus, 1949 consumption of fuel will be 134.5 percent of the 1948 consumption, or 120,620 tons. (89,680 x 134.5 percent -- columns 2 and 3)

Table 14

Estimated Consumption of Petroleum Products in Rumania by Rail Transport
1946-55

Year	1 Daily Car Loadings a/ (Hundred Units)	2 Percent Increase in Loadings over Previous Year	3 Working Freight Car Park b/ (Units)	4 Percent Change in Car Park from Previous Year	5 Percent Increase in Loadings over Park Increase c/	6 Consumption of Fuel Oil in Previous Year (Thousand Metric Tons)	7 Consumption of Fuel Oil in Current Year d/ (Thousand Metric Tons)	8 Consumption of Lubricants in Current Year e/ (Thousand Metric Tons)
1946	N.A.		N.A.				418 f/	47
1947	N.A.		N.A.			418	376 g/	42
1948	49	N.A.	34,300	N.A.	15.50	376	434	48
1949	55	12.24	33,550	- 2.19	14.43	434	497	55
1950	62	12.73	37,200	+ 10.88	1.85	497	506	56
1951	75	20.97	40,500	+ 8.87	12.10	506	567	63
1952	78	4.00	39,390	- 2.74	6.74	567	605	67
1953	91	16.67	43,680	+ 10.89	5.78	605	640	71
1954	91	00.00	41,860	- 4.17	4.17	640	667	74
1955	96	05.49	43,200	+ 3.20	2.29	667	682	76

i. 7/
8/
a. For 1948-55 the excess of percentage increase is obtained by subtracting column 4 from column 2. The excess for 1948 is obtained by graphic projection from plotted 1948-55 data. The purpose of this column is given in footnote d, below.

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Table 14

Estimated Consumption of Petroleum Products in Rumania by Rail Transport
1946-55
(Continued)

d. It is suggested that in using the concept, "fuel consumption is a function of ton-kilometers," it should be recognized that, while both the tons and the kilometers are important, the fuel consumption-to-distance relationship will be much closer to 1:1 than the consumption-to-tonnage ratio; the latter would be 1:1 only at the peak of theoretical efficiency, while the former, being largely independent of the efficiency factor, may safely be put at 1:1 for all practical purposes. The Rumanian railroads were not near operational peak efficiency in 1946, nor are they in 1955, despite the significant increase in ton-kilometers performed.

The present methodology concentrates, therefore, on determining the increase in distance that the heavier tonnages are hauled each year, and for this purpose a daily-car-loadings-to-working-freight-car-park relationship is utilized.

An increase in daily car loadings can result only because of: (1) more working freight cars, (2) shorter trips, or (3) more trips per car -- that is, greater utilization of each car.

The first condition (increased number of freight cars) would account for a portion of any increase in daily car loadings -- that is, it would be reasonable to expect a 10-percent increment in the car park to result in a 10-percent increment in loadings. The second condition (shorter average hauls) has been omitted from the calculations in the belief that, for consumption of the magnitudes involved, the added computations would not add significantly to the accuracy of the final fuel figures. During the 1948-55 period, the shortening of the average length of haul ranges from a maximum factor of .0289 in 1949 (from 1948) to a minimum of .0045 for the years 1954 and 1955. The third condition (an increase in the number of trips per car) is significant, since it equates to greater distances travelled and increased fuel consumed.

Considering conditions (1) and (3), it may be assumed that, from one year to another, any increase in daily car loadings that exceeds the increase in working freight car park represents the increase in distance hauled. For example, from 1950 to 1951, the park rose from 37,200 cars to 40,500 cars, a factor of 1.0887. Referring to condition (1) above, the daily loadings would be expected to rise by the same factor, from 6,200 in 1950 to 6,750 in 1951. In actuality, however, they rose to 7,500, by a factor of 1.2097 over 1950. The difference must represent condition (3) -- that is, during 1951 freight trains travelled 0.1210 more distance than in 1950, thereby consuming .1210 more fuel. These are the differentials which appear in column 5, which, multiplied by column 6, yield column 7, because of conditions (1) and (3) above. Lacking engineering data on the efficiency of Rumanian locomotives, no calculation is shown to account for the influence of added tonnage on consumption of fuel. Much or all of the increased consumption, however, may be included already in the current estimate because of the 20 percent margin of error.

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Table 14

Estimated Consumption of Petroleum Products in Rumania by Rail Transport
1946-55
(Continued)

e. Obtained by multiplying fuel oil consumption (column 7) by 0.1115, a rate based on a Soviet estimate for 1951. 9/

f. The most recent firm figure for consumption of fuel oil by Rumanian railroads is for 1946. 10/ This quantity includes the carriage of freight, passengers, motive units, and rolling stock. The necessary assumptions are that the fuel oil-to-coal ratio and the passenger-to-freight relationship remained substantially constant during the 1946-55 period. Certain rather inconclusive evidence in support of the first assumption is obtained by a comparison of a 1952 report with 1946 fuel oil-to-coal consumption statistics. In 1946 the tonnage of fuel oil consumed was 29.23 percent of the total fuel oil and coal tonnage. 11/ In August 1952, 32 percent of the locomotive park at the Arad depot was reportedly oil-fired. 12/

g. For 1947, there are official statistics on domestic consumption of fuel oil. Comparing official figures of 1946 and 1947, the latter year was one of decreased domestic consumption of petroleum. The national figures show a drop of 20 percent in fuel oil used during 1947. 13/ Because of the increasing demand for fuel oil by the railroads 14/ and the increasing substitution of natural gas for fuel oil in industry, 15/ however, it seems more realistic to scale the consumption of oil by railroads in 1946 down by 10 percent rather than the full 20 percent.

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Table 15

Flight Statistics for Rumanian Civil Air Transport
1955

Origin of Flight	Intermediate Points	Terminus of Flight	Distance per Flight (Kilometers) a/	Total Distance Flown per Year (Statute Miles) b/	Hours Flown per Year c/
Bucharest	Galati, Tulcea	Galati	318	123,225	1,248
Bucharest	Bacau	Iasi	323	125,163	1,248
Bucharest	Cluj	Baia-Mare	450	174,375	1,404
Bucharest	Sibiu	Cluj	330	127,875	1,248
Bucharest	Targul-Mures	Oradea	454	175,925	1,456
Bucharest	Timisoara	Arad	444	172,050	1,560
Bucharest	Targul-Mures, Cluj	Baia-Mare	450	174,375	1,508
Bucharest	Budapest	Prague	1,181	152,547	1,248
Total				1,225,535	10,920

a. 16/
b. Two domestic flights per day, 6 days per week, 52 weeks per year equal 624 domestic flights per year; 4 international flights per week equal 208 foreign flights per year.
c. Prorated to an annual basis from information for March 1955. 17/

Table 16

Estimated Consumption of Petroleum Products
by Rumanian Civil Air Transport a/
1950-55

	1	2	3	4	5	6
			Consumption of Gasoline			
Year	Total Distance Flown b/ (Thousand Statute Miles)	Hours Flown per Year c/	In Flight d/ (Metric Tons)	Total e/ (Metric Tons)	Consumption of Lubricants f/ (Metric Tons)	Total Consumption of Petroleum Products (Metric Tons)
1950	1,090	9,732	2,102	2,382	48	2,430
1951	1,116	9,964	2,152	2,438	49	2,487
1952	1,142	10,196	2,202	2,495	50	2,545
1953	1,169	10,438	2,255	2,555	51	2,606
1954	1,197	10,688	2,309	2,616	52	2,668
1955	1,226	10,946	2,364	2,678	54	2,732

a. Official Rumanian statistics report "domestic" consumption of aviation gasoline in 1947 as 4,190 tons (1,549,618 gallons). 18/ Without greater certainty as to the exact composition of this figure, however, it cannot be used with safety to launch any straight-line projection for civil consumption through subsequent years. When this figure is applied to the estimated hours flown during 1947 (computed by dividing the distance given as flown in 1947, 1,015,830 miles, by the estimated average speed of 112 miles per hour, resulting in an estimated 9,070 flying hours), a fuel consumption rate of about 150 gallons per hour (after deductions for losses) results. This rate is considered out of line for the LI-2's, Lockheed 14's, and even the tri-motor JU-52's which made up the 1947 fleet. 19/ It is conjectured, therefore, that the figure for Rumanian consumption of aviation gasoline in 1947 includes more than consumption by civil airlines.

b. Distances for 1950-55 are derived mainly by interpolation between firm Rumanian data for 1947 (1,015,830 miles 20/) and the 1955 estimate contained in this report. (See Table 15, p. 21, above).

c. Based on average speed of 112 miles per hour, derived from data in Table 15 (1,225,535 ÷ 10,920).

d. The consumption factor for type LI-2 (predominant in the Rumanian fleet in 1950-52) is 80 US gallons per hour. Based on a US estimate this includes consumption in flight, warm-up, and taxiing. The weight of 80 US gallons of aviation gasoline is 0.216 tons. 21/

e. Ten percent is added to "gasoline consumed in flight" to account for loss in transport to field and for maintenance consumption. To this result is applied a 3-percent ground loss factor (fueling, and the like), based on a US estimate. Column 4 is thus 113.3 percent of column 3.

f. The consumption of lubricants is estimated at 2 percent of fuel, on the basis of US experience. 22/

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Table 17

Estimated Consumption of Petroleum Products in Rumania by Inland Water Transport, by Type of Product and by Type of Vessel
1950 and 1952

Year	Type of Vessel and Fuel Consumed	Horsepower	1 Number of Petroleum-Burning Vessels in Group	2 Total Horsepower a/*	3 Average Number of Hours Under Way b/	4 Horsepower-Hours Under Way c/ (Thousands)	5 Consumption of Petroleum per Horsepower Under Way d/ (Metric Tons)	6 Consumption of Petroleum per Horsepower-Hour Under Way e/ (Metric Tons)	7 Average Number of Hours at Anchor f/	8 Horsepower-Hours at Anchor g/ (Thousands)	9 Consumption of Petroleum per Horsepower-Hour at Anchor h/ (Metric Tons)	10 Consumption of Petroleum at Anchor i/ (Metric Tons)	11 Total Consumption of Petroleum Fuel j/ (Metric Tons)	12 Consumption of Lubricating Oil per Horsepower-Hour k/ (Metric Tons)	13 Total Horsepower Hours (Thousands) l/	14 Consumption of Lubricating Oil per Horsepower-Hour m/ (Metric Tons)	15 Total Consumption of Petroleum n/ (Metric Tons)
1950																	
	Tug																
	Residual fuel oil	+ o/	1	1,200	3,308 p/	3,970	0.000499	1,981	1,102	1,322	0.000164	217	2,198	0.000006	5,292	32	2,230
	Residual fuel oil	- q/	14 r/	6,023 r/	3,308	19,924	0.001089	21,697	1,102	6,637	0.000164	1,088	22,785	0.000006	26,561	159	22,944
	Reported		(5)	(3,475)													
	Assumed		(9)	(2,548) s/													
	Diesel fuel	+ o/	1	1,970	3,308	6,517	0.000195	1,271	1,102	2,171	0.000005	11	1,282	0.000007	8,688	61	1,343
	Diesel fuel	- q/	8	3,275	3,308	10,834	0.000213	2,308	1,102	3,609	0.000005	18	2,326	0.000007	14,443	101	2,427
	Passenger vessel																
	Residual fuel oil	+ o/	0	0													
	Residual fuel oil	- q/	7 r/	2,700 r/	2,867 t/	7,741	0.001089	8,430	1,543	4,166	0.000164	683	9,113	0.000006	11,907	71	9,184
	Reported		(1)	(570)													
	Assumed		(6)	(2,130) u/													
	Diesel fuel	+ o/	0	0													
	Diesel fuel	- q/	2	400	2,867	1,147	0.000213	244	1,543	617	0.000005	3	247	0.000007	1,764	12	259
	Barge																
	Residual fuel oil	+ o/	0	0													
	Residual fuel oil	- q/	1 r/	390 r/	2,205 v/	860	0.001089	937	2,205	860	0.000164	141	1,078	0.000006	1,720	10	1,088
	Reported		(1)	(390)													
	Assumed		(0)	(0)													
	Diesel fuel	+ o/	2	2,500	2,205	5,513	0.000195	1,075	2,205	5,513	0.000005	28	1,103	0.000007	11,026	77	1,180
	Diesel fuel	- q/	6	1,575	2,205	3,473	0.000213	740	2,205	3,473	0.000005	17	757	0.000007	6,946	49	806
1952																	
	Tug																
	Residual fuel oil	+ o/	1	1,200	3,308 p/	3,970	0.000499	1,981	1,102	1,322	0.000164	217	2,198	0.000006	5,292	32	2,230
	Residual fuel oil	- q/	14 r/	5,983 r/	3,308	19,792	0.001089	21,553	1,102	6,593	0.000164	1,081	22,634	0.000006	26,385	158	22,792
	Reported		(5)	(3,475)													
	Assumed		(9)	(2,508) w/													
	Diesel fuel	+ o/	1	1,970	3,308	6,517	0.000195	1,271	1,102	2,171	0.000005	11	1,282	0.000007	8,688	61	1,343
	Diesel fuel	- q/	21	8,435	3,308	27,903	0.000213	5,943	1,102	9,295	0.000005	46	5,989	0.000007	37,198	260	6,249
	Passenger vessel																
	Residual fuel oil	+ o/	0	0													9,083
	Residual fuel oil	- q/	6 r/	2,670 r/	2,867 x/	7,655	0.001089	8,336	1,543	4,120	0.000164	676	9,012	0.000006	11,775	71	9,083
	Reported		(1)	(570)													
	Assumed		(5)	(2,100) y/													
	Diesel fuel	+ o/	0	0													
	Diesel fuel	- q/	2	320	2,867	917	0.000213	195	1,543	494	0.000005	2	197	0.000007	1,411	10	207
	Barge																
	Residual fuel oil	+ o/	0	0													
	Residual fuel oil	- q/	1 r/	390 r/	2,205 v/	860	0.001089	937	2,205	860	0.000164	141	1,078	0.000006	1,720	10	1,088
	Reported		(1)	(390)													
	Assumed		(0)	(0)													
	Diesel fuel	+ o/	2	2,500	2,205	5,513	0.000195	1,075	2,205	5,513	0.000005	28	1,103	0.000007	11,026	77	1,180
	Diesel fuel	- q/	6	1,575	2,205	3,473	0.000213	740	2,205	3,473	0.000005	17	757	0.000007	6,946	49	806

* Footnotes for Table 17 follow on p. 25.

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Table 17

Estimated Consumption of Petroleum Products in Rumania by Inland Water Transport, by Type of Product and by Type of Vessel
1950 and 1952
(Continued)

a. Estimates of horsepower (hp) aggregates are compiled from detailed analysis and comparison of six reports on the Rumanian river fleet. 23/
b. The average work-year is put at 365 days, less 40 days lost because of weather conditions, 24/ less 10 days for repairs made during the navigable season. The average day is put at 14 hours, based on Danubian traffic studies. 25/ The average year is estimated, therefore, at 4,410 working hours available for river transport. Further reductions apply to each type of vessel, as noted below.
c. Obtained by multiplying columns 2 and 3.
d. Based on Soviet experience. 26/
e. Obtained by multiplying columns 4 and 5.
f. Obtained by subtracting column 3 from 4,410, the total work hours available per average year.
g. Obtained by multiplying columns 2 and 7.
h. Based on Soviet and US studies. 27/
i. Obtained by multiplying columns 8 and 9.
j. Obtained by adding columns 6 and 10.
k. Based on Soviet experience. 28/
l. Obtained by adding columns 4 and 8.
m. Obtained by multiplying columns 12 and 13.
n. Obtained by adding columns 11 and 14.
o. More than 1,000 hp.
p. Hours under way for tugs estimated at 75 percent of total hours available (75 percent of 4,410 hours per year). Based on a CIA estimate for the USSR. 29/
q. Less than 1,000 hp.
r. Obtained by adding the "reported" and "assumed" figures given in parentheses immediately following.
s. Fifty percent of 17 steam tugs with an aggregate rating of 5,095 hp are assumed to be oil burning.
t. Lacking data on sailing schedules, "hours under way" are arbitrarily estimated at 65 percent of total hours available per year (65 percent of 4,410 hours). The length of Rumanian waterways renders plausible the assumption that the average river passenger boat is under way 2 days (about 200 miles), with 1 day at anchor.
u. Fifty percent of 11 steam passenger boats with an aggregate rating of 4,260 hp are assumed to be oil burning.
v. Self-propelled barges are estimated to be under way about 50 percent of the total available hours (50 percent of 4,410 hours per year), based on a CIA estimate for the USSR. 30/
w. Fifty percent of 18 steam tugs with an aggregate rating of 5,015 hp are assumed to be oil burning.
x. Fifty percent of 10 steam passenger vessels with an aggregate rating of 4,200 hp are assumed to be oil burning.

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Table 18

Estimated Consumption of Diesel Fuel and Lubricants in Rumania by Inland Water Tugs of Less Than 1,000 Horsepower a/
1950-55

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Year	Number of Diesel Tugs	Total Horsepower	Average Number of Hours Under Way	Horsepower-Hours Under Way (Thousands)	Consumption of Petroleum per Horsepower Under Way (Metric Tons)	Consumption of Petroleum Under Way (Metric Tons)	Average Number of Hours at Anchor	Horsepower-Hours at Anchor (Thousands)	Consumption of Petroleum per Horsepower-Hour at Anchor (Metric Tons)	Consumption of Petroleum at Anchor (Metric Tons)	Total Consumption of Petroleum Fuel (Metric Tons)	Consumption of Lubricating Oil per Horsepower-Hour (Metric Tons)	Total Horsepower-Hours (Thousands)	Consumption of Lubricating Oil per Horsepower-Hour (Metric Tons)	Total Consumption of Petroleum (Metric Tons)
1950	6 b/	3,275 b/	3,308	10,834	0.000213	2,308	1,102	3,609	0.000005	18	2,326	0.000007	14,443	101	2,427
1951	15 c/	6,030 d/	3,308	19,947	0.000213	4,249	1,102	6,645	0.000005	33	4,282	0.000007	26,592	186	4,468
1952	21 e/	8,435 e/	3,308	27,903	0.000213	5,943	1,102	9,295	0.000005	46	5,989	0.000007	37,198	260	6,249
1953	23	9,246 d/	3,308	30,586	0.000213	6,515	1,102	10,189	0.000005	51	6,566	0.000007	40,775	285	6,851
1954	25	10,050 d/	3,308	33,245	0.000213	7,081	1,102	11,075	0.000005	55	7,136	0.000007	44,321	310	7,446
1955	27	10,854 d/	3,308	35,905	0.000213	7,648	1,102	11,961	0.000005	60	7,708	0.000007	47,866	335	8,043

a. Analysis of the reported composition of the Rumanian inland fleet for 1950 and 1952 indicates that the increase from 55 units in 1950 to 68 units in 1952 was almost entirely the result of an increase in the number of diesel tugs of less than 1,000 hp -- from 8 in 1950 to 21 in 1952. In 1953 a total of 48 tugs was reported, 31/ an increase of 2 tugs over the total number counted for 1952. 32/ On the basis of the nature of the increase between 1950 and 1952, it is assumed that the 2 additional tugs in 1953 were also of the diesel type, of less than 1,000 hp, and it is considered reasonable to assume that the same increase of 2 diesel tugs (of less than 1,000 hp) per year was made during 1954 and 1955. No other increase in the fleet are reported, and the estimated consumption of petroleum products by diesel tugs (of less than 1,000 hp) for 1953-55, as derived in this table, is assumed to represent the total increase in consumption by the inland fleet for these years. These data are incorporated in Table 19, p. 27, below.

b. See Table 17, p. 23, above.

c. Interpolated between the 1950 and the 1952 data.

d. Obtained by using an average of 402 hp per unit, based on the 1952 fleet of diesel tugs of less than 1,000 hp.

e. See Table 17, p. 23, above.

Table 19

Estimated Consumption of Petroleum Products in Rumania by Inland Water Transport, by Type of Product and by Type of Vessel
1950-55

Metric Tons

Type of Vessel and Product Consumed	Horsepower	Consumption of Petroleum Fuel						Consumption of Lubricants					
		1950 a/	1951 b/	1952 a/	1953 b/	1954 b/	1955 b/	1950 a/	1951 b/	1952 a/	1953 b/	1954 b/	1955 b/
Tug													
Residual fuel oil	+ c/	2,198	2,198	2,198	2,198	2,198	2,198	32	32	32	32	32	32
Residual fuel oil	- d/	22,785	22,634	22,634	22,634	22,634	22,634	159	158	158	158	158	158
Diesel fuel	+ c/	1,282	1,282	1,282	1,282	1,282	1,282	61	61	61	61	61	61
Diesel fuel	- d/	2,326	4,282 e/	5,989	6,566 e/	7,136 e/	7,708 e/	101 e/	186 e/	260 e/	285 e/	310 e/	335 e/
Passenger vessel													
Residual fuel oil	- d/	9,113	9,010	9,010	9,010	9,010	9,010	71	71	71	71	71	71
Diesel fuel	- d/	247	197	197	197	197	197	12	10	10	10	10	10
Barge													
Residual fuel oil	- d/	1,078	1,078	1,078	1,078	1,078	1,078	10	10	10	10	10	10
Diesel fuel	+ c/	1,103	1,103	1,103	1,103	1,103	1,103	77	77	77	77	77	77
Diesel fuel	- d/	757	757	757	757	757	757	49	49	49	49	49	49
Total residual fuel oil		35,174	34,920	34,920	34,920	34,920	34,920						
Total diesel fuel		5,715	7,621	9,328	9,905	10,475	11,047						
Total lubricant		572	654	728	753	778	803						
Total petroleum products		41,461	43,195	44,976	45,578	46,173	46,770						

a. Obtained from Table 17, p. 23, above.
b. In the absence of information for 1951, it seems conservative to attribute to 1951 the 1952 figures (which are lower than those for 1950). 1952 figures are also attributed to the 1953-55 period, since no increase in the fleet is reported after 1952, except in diesel-tugs of less than 1,000 hp, as shown above.
c. More than 1,000 hp.
d. Less than 1,000 hp.
e. Obtained from Table 18, p. 26, above.

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Table 20

Estimated Consumption of Petroleum Products in Rumania by Ocean Water Transport, by Type of Product and by Type of Vessel
1950 and 1951-55

Year	Type of Product Consumed	Horsepower of Consuming Vessels	1 Number of Petroleum-Burning Vessels in Group a/	2 Total Horsepower b/	3 Average Number of Hours Under Way c/	4 Horsepower-Hours Under Way d/ (Thousands)	5 Consumption of Petroleum per Horsepower Under Way e/ (Metric Tons)	6 Consumption of Petroleum Under Way f/ (Metric Tons)	7 Average Number of Hours at Anchor g/	8 Horsepower-Hours at Anchor h/	9 Consumption of Petroleum per Horsepower-Hour at Anchor i/ (Metric Tons)	Co Pe / (Me
1950												
	Residual fuel oil	+ p/	3	7,250	3,375	24,469	0.000499	12,210	4,401	31,907	0.000095	
	Diesel fuel	+ p/	2	13,300	3,600	47,880	0.000195	9,337	4,176	55,541	0.000040	
	Total		5									
1951-55 q/												
	Residual fuel oil	+ p/	3	7,250	3,375	24,469	0.000499	12,210	4,401	31,907	0.000095	
	Diesel fuel	+ p/	2	13,300	3,600	47,880	0.000195	9,337	4,176	55,541	0.000040	
	Diesel fuel	- r/	4	2,000	3,935	7,870	0.000213	1,676	3,841	7,682	0.000040	
	Total		9									

a. 33/
b. US Maritime Commission files
c. Obtained from Table 21 (column 8), p. 31, below.
d. Obtained by multiplying columns 2 and 3.
e. Based on Soviet statistics. 34/
f. Obtained by multiplying columns 4 and 5.
g. Obtained by subtracting column 3 from 7,776, the hours available for navigation per year in the Black Sea-Mediterranean area. This estimate of total hours available is based on a loss of 18 days a year in this area because of weather; a l days a year for minor repairs during the navigable season (US experience). 365 days per year less (18 + 8 + 15) = 324 days, or 7,776 hours.
h. Obtained by multiplying columns 2 and 7.
i. Based on Soviet statistics. 35/
j. Obtained by multiplying columns 8 and 9.
k. Obtained by adding columns 6 and 10.
l. Based on a Soviet study. 36/
m. Obtained by multiplying total hours available per year (7,776) by column 2.
n. Obtained by multiplying columns 12 and 13.
o. Obtained by adding columns 11 and 14.
p. More than 1,000 hp.
q. There has been no reported increase in the Rumanian merchant marine since 1951.
r. Less than 1,000 hp.

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10	11	12	13	14	15
sumption of troleum at chor j/ tric Tons)	Total Consumption of Petroleum Fuel k/ (Metric Tons)	Consumption of Lubricating Oil per Horsepower-Hour l/ (Metric Tons)	Total Horsepower Hours m/ (Thousands)	Consumption of Lubricating Oil per Horsepower-Hour n/ (Metric Tons)	Total Consumption of Petroleum o/ (Metric Tons)
3,031	15,241	0.000006	56,376	338	15,579
2,222	11,559	0.000007	103,421	724	12,283
	26,800			1,062	27,862
3,031	15,241	0.000006	56,376	338	15,579
2,222	11,559	0.000007	103,421	724	12,283
307	1,983	0.000007	15,552	109	2,092
	28,783			1,171	29,954

oss of 80 days every 10 years for major overhaul, based on US experience (8 days a year); plus a loss of 15

Table 21

Estimated Average Number of Hours Under Way by the Rumanian Petroleum-Burning Ocean Fleet, by Type of Product and by Vessel
1950-55

1		2	3	4	5	6	7	8
Vessel by Type of Product Consumed	Horsepower	Speed a/* (Knots)	Average Speed by Vessel Type b/ (Knots)	Average Trip c/ (Nautical Miles)	Average Number of Hours Under Way per Trip d/	Average Number of Hours at Anchor per Trip e/	Percent of Total Time Under Way per Trip f/	Total Hours Under Way per Year g/
A. Residual fuel oil	+ h/		10.7	986	92	120	43.4	3,372
SS Ardeal		11						
SS Bereaina		10						
SS Dimitrov		11						
B. Diesel fuel	+ h/		16	986	62	72 i/	46.3	3,600
MS F. Engels		10						
MS Transilvania		22						
C. Diesel fuel	- j/		8	986	123	120	50.6	3,935
MS Sulina		8						
MS Mangolia		8						
MS Constanta		8						
MS Midia		8						

a. 37/
b. Arithmetical average of the speeds of ships comprising each subgroup (A, B, and C in column 1).
c. Available reports on the movements of the Rumanian merchant marine most frequently mention the following ports of call: Constanta, Rumania; Durres, Albania; Haifa, Israel; Beirut, Lebanon; and Alexandria, Egypt. 38/ Although the reports cover 1952 and 1953 almost exclusively, in the absence of evidence of different trade-route patterns they are considered representative both of 1950-51 and of 1954-55. Western European ports are noted very infrequently, as are runs to nearby Soviet ports on the Black Sea. Making the arbitrary assumption that, for purposes of estimating the length of an average trip, the "above-average" distances of infrequent trips to Western Europe are roughly balanced by the "below-average" distances of the probably more frequent trips to nearby Black Sea ports (Odessa, Burgas), it is probably not unrealistic to use the arithmetical average of the distances between the four ports mentioned above as an estimate of the distance of the average trip. The use of distance tables puts this average at 986 nautical miles.

* Footnotes for Table 21 follow on p. 32.

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Table 21

Estimated Average Number of Hours Under Way by the Rumanian Petroleum-Burning Ocean Fleet, by Type of Product and by Vessel
1950-55
(Continued)

d. Obtained by dividing column 4 by column 3.
e. The average time spent at anchor for loading by freighters is estimated at 5 days, or 120 hours, per trip, based on inspection of published freighter-loading and sailing schedules. All ships in this subgroup A are cargo ships.
f. Obtained by dividing column 5 by the sum of columns 5 and 6.
g. Obtained by multiplying column 7 by 7,776, the total hours available per year for navigation in the Black Sea-Mediterranean area.
h. More than 1,000 hp.
i. The two ships in Category B are assumed to have widely differing layover times between trips. The freighter F. Engels is given 120 hours at anchor per trip (see footnote e, above), while the passenger ship MS Transilvania is estimated to load 24 hours per trip, on the basis of her reported schedule. 39/ The arithmetical average time at anchor for Category B is 72 hours.
j. Less than 1,000 hp.

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Table 22

Estimated Consumption of Petroleum Products in Rumania by Ocean Transport, by Type of Product a/
1950-55

Type of Product	1950	1951 b/	1952 b/	1953 b/	1954 b/	1955 b/
Residual fuel oil	15,241	15,241	15,241	15,241	15,241	15,241
Diesel fuel	11,559	13,542	13,542	13,542	13,542	13,542
Lubricants	1,062	1,171	1,171	1,171	1,171	1,171
Total petroleum products	27,862	29,954	29,954	29,954	29,954	29,954

a. Collated from data in Table 20, p. 29, above.
b. Since 1951 there has been no reported increase in the ocean-going fleet.

Table 23

Estimated Consumption of Petroleum Products in Rumania by Agricultural Tractors in Field Work
1947-55

		1	2	3	4	5	6	7	8	9	10	11
Year	Type of Tractor	Total Number of Tractors on Hand Jan 1	Number Adjusted for Repair Factor a/*	Number of Tractor-Hours b/ (Thousands)	Number of Tractors Added from Production c/	Number Added Adjusted for Repair Factor d/	Number of Tractor-Hours Added from Production e/ (Thousands)	Total Tractor-Hours f/ (Thousands)	Average Consumption of Diesel Fuel per Hour g/ (Kilograms)	Consumption of Diesel Fuel h/ (Metric Tons)	Consumption of Gasoline i/ (Metric Tons)	Consumption of Lubricants j/ (Metric Tons)
1947 k/	Hanomag	6,000	3,600									
	IAR-22				340	306						
1948 k/	Hanomag	3,600	2,160									
	IAR-22	306	184		940	846						
1949 k/	Hanomag	2,160	1,296									
	IAR-22	1,030	618		1,265	1,139						
	IAR-23				635	572						
1950	Hanomag	1,296	778	840				840	4.60	3,864	116	193
	IAR-22	1,757	1,054	1,138				1,138	4.60	5,235	157	262
	IAR-23	572	343	370	1,820	1,638	1,333	1,703	3.72	6,335	190	317
	SRI-1				1,500	1,350	1,098	1,098	5.34	5,863	176	293
	Total									21,297	639	1,065
1951	Hanomag	778	467	504				504	4.60	2,318	70	116
	IAR-22	1,054	632	683				683	4.60	3,142	94	157
	IAR-23	1,981	1,189	1,284	700	630	513	1,797	3.72	6,685	201	334
	SRI-1	1,350	810	875	1,650	1,485	1,208	2,083	5.34	11,123	334	556
	KD-35				1,000	900	732	732	5.34	3,909	117	195
	Total									27,177	816	1,358
1952	Hanomag	467	280	302				302	4.60	1,389	42	69
	IAR-22	632	379	409				409	4.60	1,881	56	94
	IAR-23	1,819	1,091	1,178				1,178	3.72	4,382	131	219
	SRI-1	2,295	1,377	1,487				1,487	5.34	7,941	238	397
	KD-35	900	540	583	3,800	3,420	2,783	3,366	5.34	17,974	539	899
	Total									33,567	1,006	1,678
1953	Hanomag	280	168	181				181	4.60	833	25	42
	IAR-22	379	227	245				245	4.60	1,127	34	56
	IAR-23	1,091	655	707				707	3.72	2,630	79	132
	SRI-1	1,377	826	892				892	5.34	4,763	143	238
	KD-35	3,960	2,376	2,566	4,650	4,185	3,405	5,971	5.34	31,885	957	1,594
	Total									41,238	1,238	2,062
1954	Hanomag	168	101	109				109	4.60	501	15	25
	IAR-22	227	136	147				147	4.60	676	20	34
	IAR-23	655	393	424				424	3.72	1,577	47	79
	SRI-1	826	496	536				536	5.34	2,862	86	143
	KD-35	6,561	3,937	4,252	5,000	4,500	3,661	7,913	5.34	42,255	1,268	2,113
	Total									47,871	1,436	2,394
1955	Hanomag	101	61	66				66	4.60	304	9	15
	IAR-22	136	82	89				89	4.60	409	12	20
	IAR-23	393	236	255				255	3.72	949	28	47
	SRI-1	496	298	322				322	5.34	1,719	52	86
	KD-35	8,437	5,062	5,467	5,000	4,500	3,661	9,128	5.34	48,744	1,462	2,437
	Total									52,125	1,563	2,605

* Footnotes for Table 23 follow on p. 35.

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Table 23

Estimated Consumption of Petroleum Products in Rumania by Agricultural Tractors in Field Work
1947-55
(Continued)

a. Based on a reported constant loss of 40 percent to the tractor park because of repairs, 40/ this column represents 60 percent of column 1.
b. It is estimated that an agricultural tractor engages in field work for an average of 180 days at 6 hours per day. This period includes the time spent in all operations -- plowing, cultivating, seeding, harvesting, and the like. Thus the quantities for column 3 are obtained by multiplying the number of serviceable tractors, column 2, by 1,080 hours per year.
c. Based on a coordination of annual production totals, reported and estimated, with reported starting and terminal production dates for the several types of tractors.
d. In view of the constant 40-percent repair factor applying to older tractors, a 10-percent repair factor is deemed reasonable for newly produced units. The rate is raised to 40 percent for all subsequent years.
e. The production year is divided into 2 periods, 1 of 180 days, coinciding with the number of days each year that tractors are engaged in field work, and another of 185 days, falling outside this "field" period. It is calculated that each tractor produced during a year has a potential utilization of an average of 135.6 "field" days or, at 6 hours a day, 813.6 hours per year. The calculation may be expanded as follows: Assuming a production rate of 1 tractor per day, the 185-day period yields 185 tractors with the full 180-day "field" potential or 33,300 tractor "field" days. The tractor produced on the first day of the 180-day "field" period has an average potential of 179.5 "field" days; that produced on the second day, an average potential of 178.5 "field" days; and so on. At the end of the 180-day period, 180 tractors have been produced with a total of 16,200 "field" days. $[179.5 + 178.5 + \ldots 0.5 = (179.5 + 0.5)\frac{180}{2}]$. The addition of these 16,200 "field" days to the 33,300 above, divided by the assumed annual production of 365 tractors, results in an average of 135.6 potential "field" days for each tractor produced. Converted to hours, this factor 813.6 is multiplied by column 5 to obtain column 6.
f. Obtained by adding columns 3 and 6.
g. Based on the average quantities of gasoline consumed per acre for various agricultural operations in the US, 41/ consumption of fuel for all operations approximates 60 percent of the quantity consumed during plowing. Using this approximation, the rates of fuel consumption per hectare of plowing for the tractor types IAR-22, IAR-23, 42/ and the German "Hanomag" (of which the IAR-22 is a Rumanian copy) are adjusted for over-all operations and appear in this column converted to hourly rates. Rates of consumption for plowing by the KD-35 tractor 43/ and the SRI-1 (the IAR-23 chassis powered by a KD-35 engine) are similarly scaled downward for a better approximation of the total rate of consumption. The base rate for the IAR-22 is taken from its third-gear characteristics in view of the reported complaint that its power is inadequate for agricultural work. The unadjusted rates for the IAR-23 and KD-35 are characteristic of second-gear operation.
h. Obtained by multiplying columns 7 and 8.
i. Estimated at 3 percent of the diesel fuel consumed, based on studies of Soviet diesel tractors. 44/
j. Estimated at 5 percent of the diesel fuel consumed, based on studies of Soviet diesel tractors. 45/
k. Data for 1947-49 are given only where they are necessary for the derivation of 1950 data.

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Table 24

Estimated Total Consumption of Petroleum Products
in Rumania by Agricultural Tractors
1950-55

Metric Tons

	1	2	3	4	5
Year and Type of Product	Field Work [a]/*	Nonfield Work [b]/	All Work [c]/	Loss in Storage and Hauling [d]/	Total Petroleum Products [e]/
1950					
Diesel fuel	21,297	2,130	23,427	1,171	24,598
Gasoline	639	64	703	35	738
Lubricants	1,065	107	1,172	59	1,231
1951					
Diesel fuel	27,177	2,718	29,895	1,495	31,390
Gasoline	816	82	898	45	943
Lubricants	1,358	136	1,494	75	1,569
1952					
Diesel fuel	33,567	3,357	36,924	1,846	38,770
Gasoline	1,006	101	1,107	55	1,162
Lubricants	1,678	168	1,846	92	1,938
1953					
Diesel fuel	41,238	4,124	45,362	2,268	47,630
Gasoline	1,238	124	1,362	68	1,430
Lubricants	2,062	206	2,268	113	2,381

* Footnotes for Table 24 follow on p. 37.

Table 24

Estimated Total Consumption of Petroleum Products in Rumania by Agricultural Tractors 1950-55 (Continued)

Metric Tons

Year and Type of Product	1 Field Work a/	2 Nonfield Work b/	3 All Work c/	4 Loss in Storage and Hauling d/	5 Total Petroleum Products e/
1954					
Diesel fuel	47,871	4,787	52,658	2,133	55,291
Gasoline	1,436	144	1,580	79	1,659
Lubricants	2,394	239	2,633	132	2,765
1955					
Diesel fuel	52,125	5,213	57,338	2,867	60,205
Gasoline	1,563	156	1,719	86	1,805
Lubricants	2,605	261	2,866	143	3,009

a. Data transferred from columns 9, 10, and 11 of Table 23, p. 34, above.
b. Nonfield work is put at 10 percent of field work. Studies of the Soviet tractor place this percentage at 13.2 percent in the USSR. 46/ The somewhat lower figure is used arbitrarily for Rumania because of the generally lower level of Rumanian industrialization as compared with that of the USSR and the resulting less extensive use of tractor power in agriculture.
c. Obtained by adding columns 1 and 2.
d. Estimated at 5 percent of column 3, based on studies of Soviet tractors. 47/
e. Obtained by adding columns 3 and 4.

Table 25

Estimated Consumption of Petroleum Products
in Rumania by Agricultural Combines
1950-55

	1	2	3	4	5
Year	Number of Combines a/	Consumption of Gasoline b/ (Metric Tons)	Consumption of Lubricants c/ (Metric Tons)	Losses in Gasoline Storage and Handling d/ (Metric Tons)	Total Consumption of Gasoline e/ (Metric Tons)
1950	85	306	15	15	321
1951	160	576	29	29	605
1952	460	1,656	83	83	1,739
1953	910	3,276	164	164	3,440
1954	1,500	5,400	270	270	5,670
1955	3,300	11,880	594	594	12,474

a. Based on a tentative estimate of the grain combine park in Rumania in 1950-56.
b. Combine type S-4 consumes 18 kilograms (kg) of gasoline per hour. 48/ It is estimated that the average harvesting season in Rumania is 25 days per year at 8 hours per day. Annual consumption of gasoline per combine is thus 3.6 tons per year.
c. Estimated at 5 percent of the consumption of gasoline, based on studies of the S-4 combine. 49/
d. Estimated at 5 percent of the consumption of gasoline, based on minimum allowance for machine tractor stations in the USSR. 50/
e. Obtained by adding columns 2 and 4.

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Table 26

Estimated Consumption of Petroleum Products in Rumania by Agriculture, by Type of Machine and by Type of Product 1950-55

Metric Tons

Type of Machine and Type of Product	1950	1951	1952	1953	1954	1955
Agricultural tractors a/						
Gasoline	738	943	1,162	1,430	1,659	1,805
Diesel fuel	24,598	31,390	38,770	47,630	55,291	60,205
Lubricants	1,231	1,569	1,938	2,381	2,765	3,009
Combines b/						
Gasoline	321	605	1,739	3,440	5,670	12,474
Lubricants	15	29	83	164	270	594
Other agricultural machinery c/						
Gasoline	57	107	307	607	1,001	2,201
Lubricants	3	5	15	29	48	105
Total gasoline	1,116	1,655	3,208	5,477	8,330	16,480
Total diesel fuel	24,598	31,390	38,770	47,630	55,291	60,205
Total lubricants	1,249	1,603	2,036	2,574	3,083	3,708
Total petroleum products	26,963	34,648	44,014	55,681	66,704	80,393

a. Data taken from Table 24, p. 36, above.
b. Data taken from Table 25, p. 38, above.
c. The consumption of petroleum products in the USSR by combines is estimated at 70 percent of the total petroleum products consumed by all agricultural machinery, excluding tractors and trucks. 51/ This ratio is placed at 85 percent in Rumania, based on the generally lower level of mechanization in Rumanian agriculture. This percentage is applied to both gasoline and lubricants.

Table 27

Estimated Consumption of Kerosine in Rumania by Households
1947 and 1950-55

Metric Tons

Year	Total Consumption a/
1947	187,234 b/
1950	220,000 c/
1951	236,000 d/
1952	290,000 e/
1953	355,000 e/
1954	436,000 e/
1955	534,600 e/

a. In 1947, about 288,000 tons of "special fuel" were used for central heating. 52/ Since then the only report on heating oil, other than references to government-directed conversions from oil to gas, is one describing an inadequate supply in Bucharest. 53/ For 1950-55 the consumption is indeterminable, but is believed to have been reduced to an insignificant quantity.

b. 54/. Households are the only significant consumers of kerosine in Rumania. Rumanian agriculture reportedly uses diesel tractors exclusively.

c. Based on the text of the 1951 State Plan quoted in source 55/.

d. The 1951 State Plan calls for the domestic consumption of 239,800 tons of kerosine. 56/ In view of the frequently reported complaints of kerosine shortages during 1951, however, this official planned figure is scaled downward slightly to 236,000 tons.

e. Data for 1955 are taken from the First Five Year Plan (1951-55). Data for 1952 through 1954 are interpolated between 1951 and 1955, using an average annual increase of 22.7 percent. Although the full realization of the Plan for 1955 may be doubted, in view of past consumer difficulties and the size of past increases, recent evidence does not justify rejection of the figure.

An estimate of the size of the petroleum-consuming segment of the industrial economy of Rumania may be based on an article in the Rumanian economic journal, 57/ in which it was forecast that during 1948 the internal consumption of fuel oil would dwindle to 500,000 tons, of which 250,000 tons would be used by those industries unable to utilize other fuels. Even allowing for a wide margin of error, this is a relatively small amount of fuel oil.

On the basis of available data, 58/ the following industrial groups were selected as the most significant among potential consumers of petroleum in Rumania: petroleum refining, electric power, iron and steel, road and canal building, heavy equipment manufacturing (locomotives and tractors), shipbuilding, gas-generating, nonferrous metals, and the chemical-fertilizer-rubber-carbon black complex.

Analysis of available data on the largest plants in these industrial groups indicated that all industries except petroleum refining, electric power, and iron and steel could be eliminated as major consumers of petroleum. The others utilized gas rather than liquid fuels, particularly in newly constructed plants. Road and canal building is very largely an unknown quantity but probably is not very active, to judge from the forced halts in constructing the Danube-Black Sea Canal in 1952 and 1953 and the continuing bad condition of Rumanian highways.

Granting that the requirements for lubricants of such important consumers as heavy engineering plants have been bypassed, it is probable that a study of the petroleum refining, electric power, and iron and steel industries will account for all but an insignificant portion of industrial consumption of petroleum in Rumania.

Table 28

Estimated Consumption of Residual Fuel Oil in Rumania
by the Petroleum Refining Industry
1950-55

Thousand Metric Tons

	1	2	3	4
Year	Total Output of Refineries a/	Consumption of Fuel Oil at Refineries b/	Products Lost in Process c/	Total Products Consumed
1950	4,800	102	168	270
1951	5,900	126	206	332
1952	7,000	149	245	394
1953	7,900	168	276	444
1954	8,700	185	304	489
1955	9,500 d/	202	332	534

a. 59/
b. A comparison of the estimated output of specific products by refineries in 1950-54, as percentages of total yield, with the product patterns in Rumanian refineries for 1938, 1940, and 1942-47, 60/ indicates that refinery activities of the war year 1943 probably correspond more closely to current operations than the more recent 1945-47 years. During 1943, 3.63 percent of the total refinery output was used as refinery fuel, including both fuel oil and refinery gas. Of this amount, it is estimated that 1.5 percent consisted of refinery gas, while the balance, 2.13 percent, consisted of fuel oil. In the absence of any statistics on consumption of gas by refineries in 1943, the estimate of 1.5 percent is based on the more detailed statistics for 1945-47, adjusted downward somewhat to reflect the increased utilization of piped-in methane by Rumanian refineries since 1947. Column 2, therefore, is obtained by multiplying column 1 by 2.13 percent.
c. Estimated at 3.5 percent of the total yield. The greater part of the loss occurs in fuel-oil cracking and is included in Table 31 under consumption of residuals. 61/
d. This figure is a CIA estimate. Complete methodology and documentation for this estimate are available in CIA files.

Table 29

Estimated Consumption of Petroleum Products in Rumania
by the Electric Power Industry
1950-55 and 1960

Thousand Metric Tons

	1	2	3	4	5
Year	Total Petroleum Fuel a/	Diesel Fuel b/	Residual Fuel c/	Lubricants d/	Total Petroleum Products e/
1950	250.0	16.5	233.5	1.8	252
1951	237.5	15.7	221.8	1.7	239
1952	225.0	14.8	210.2	1.6	227
1953	212.5	14.0	198.5	1.5	214
1954	200.0	13.2	186.8	1.4	201
1955	187.5	12.4	175.1	1.3	189
1960	125.0				

a. Total consumption of fuel oil for 1950 is given in the Rumanian Ten Year Electrification Plan, published in October 1950. 62/ Data for 1960 are based on the electrification plan's goal of consumption of 120,000 tons of petroleum products by 1960. In the face of currently reported difficulties in the progress of the program, the goal is lowered by 5,000 tons as a more accurate estimate for 1960. Data for 1951-60 were obtained by applying successive deductions of 12,500 tons per year. An arithmetical series was used to correspond with the equal investments scheduled by the plan for each year.

b. The amounts in this column are based on the figure for 1952. The aggregate production statistics for diesel plants from the specifications of a list of 82 plants operable in 1952, which appear in the source, 63/ give a total of about (about 43.6 million kilowatt-hours, approximately 148,807 million British thermal units (Btu). Converting to tons of diesel fuel by dividing by 43,211 64/ yields about 3,400 tons. Inasmuch as the over-all efficiency of a diesel power plant approximates 23 percent, the total diesel fuel requirement for 1952 is placed at 14,800 tons, 6.6 percent of the total petroleum fuel in column 1. This factor is applied for each year to complete the series in column 2.

c. Obtained by subtracting column 2 from column 1.

d. Based on a factor of 0.007 applied to total consumption of petroleum fuel, derived from US and Soviet experience. 65/

e. Obtained by adding columns 2, 3, and 4.

Table 30

Estimated Consumption of Petroleum Products in Rumania by the Steel Industry
1950-55

Thousand Metric Tons

Year	1 Production of Ingots by the Gheorg-Dej Steel Plant a/	2 Production of Ingots by the Progressul Steel Plant a/	3 Total Output of Steel by Both Plants a/	4 Consumption of Fuel Oil by Open-Hearth Furnaces b/	5 Consumption of Fuel Oil by Soaking Pit c/	6 Consumption of Fuel Oil by Reheating d/	7 Total Consumption of Fuel Oil e/
1950	200 f/	30 g/	230	26	11	9	46
1951	200 f/	36 g/	236	26	12	9	47
1952	200 f/	42 g/	242	27	12	10	49
1953	230 f/	48 g/	278	31	14	11	56
1954	260 f/	55 g/	315	35	16	13	64
1955	260 f/	55 g/	315	35	16	13	64

a. Of the 6 largest Rumanian steel plants, probably only 2 (shown in columns 1 and 2) use fuel oil for firing open-hearth furnaces. During 1955 the Gheorg-Dej Plant may have utilized gas. Construction of coke ovens is planned. It is assumed that these plants also use oil for soaking pit and reheating furnaces.

b. The open-hearth method requires 4.5 million Btu to product 1 ton of steel. 66/ One kg of residual fuel oil carries an average heat value of 40,345 Btu. 67/ 4.5 million ÷ 40,345 = 111.54 kg of fuel oil required to produce 1 ton of steel. Column 4 is obtained by multiplying column 3 by this factor in tons (0.11154).

c. Soaking pit processing requires 2 million Btu per ton of steel. 68/ Dividing by 40,345 Btu per kg of fuel oil = 49.57 kg of oil per ton of steel. This factor, in tons (0.04957), is applied to column 3 to obtain column 5.

d. The fuel oil requirement for processing 1 ton of steel in reheating furnaces is equal to the soaking pit requirement. A shearing loss of 20 percent, however, requires an adjustment. A factor of 0.04 is therefore applied to column 3 to obtain the column 6 series.

e. Obtained by adding columns 4, 5, and 6. Based on an estimate for USSR (0.7 percent), 69/ lubricant use is less than 500 tons per year for the 1950-55 period.

f. 1954 data are based on source 70/. All other years are estimated on the basis of 1954 data.

g. 1954 data are based on source 71/. Other years are estimated.

Table 31

Estimated Consumption of Petroleum Products in Rumania
by Industry, by Type of Product a/
1950-55

Thousand Metric Tons

Year and Consumer	Diesel Fuel	Residuals	Lubricants b/	Total Petroleum Products
1950				
Refinery		270		270
Electric power	16	234	2	252
Iron and steel		46	Negligible	46
Other			2	2
Total	16	550	4	570
1951				
Refinery		332		332
Electric power	16	222	2	239 c/
Iron and steel		46	Negligible	47 c/
Other			2	2
Total	16	601	4	620 c/
1952				
Refinery		394		394
Electric power	15	210	2	227
Iron and steel		40	Negligible	49
Other			2	2
Total	15	653	4	672
1953				
Refinery		444		444
Electric power	14	198	2	214
Iron and steel		56	Negligible	56
Other			2	2
Total	14	698	4	716
1954				
Refinery		489		489
Electric power	13	187	1	201
Iron and steel		64	Negligible	64
Other			2	2
Total	13	740	3	756
1955				
Refinery		534		534
Electric power	12	175	1	189 c/
Iron and steel		64	Negligible	64
Other			2	2
Total	12	773	3	789

a. Data for refinery, electric power, and iron and steel are from Tables 28, 29, and 30, pp. 42, 43, and 44, respectively, above.
b. The principal users of gear lubricants, cutting oils, and the like in Rumania must be the engineering plants -- the locomotive, tractor, freight car, truck, and oil field equipment fabricators -- yet no available data are adequate for reliably aggregating any estimate. The final national estimate for consumption of lubricants, however, is not believed to be distorted significantly -- a position based on the small number of major engineering plants in the country and their modest output. A preliminary study of the locomotive-tractor-truck complex places the needs for lubricants by this group at about 1,500 tons in 1950 and 2,500 tons in 1955. The annual average of 2,000 tons as shown in the table under Other must be, therefore, a purely provisional estimate at this time.
c. The total is derived from unrounded figures and is not the sum of the rounded data shown.

APPENDIX B

GAPS IN INTELLIGENCE

Estimates of the civil consumption of petroleum products in Rumania are dependent, in many sectors, on the use of Soviet analogy. The lack of Rumanian data on these sectors constitutes the major general gap in intelligence. Direct data on all seven of the consuming sectors discussed in this report would make possible firmer estimates of civil consumption. The major specific gaps in intelligence for each of the seven sectors are described in the following paragraphs.

1. Motor Transport.

Gaps include data on total annual performance -- total miles traveled and total tonnage hauled (or typical operating details from a number of qualified sources); on rates of fuel consumption (per ton kilometer, per hour, per mile, and the like); on the size and composition of the operating truck, passenger car, and bus parks, with emphasis on diesel units; and on the extent of conversion to liquefied petroleum gas by busses and trucks.

2. Rail Transport.

Gaps include data on actual results of current programs for economizing on fuel and of programs to convert to wide use of coal and lignite; on the average operating efficiency of Rumanian locomotives -- that is, the effect of added tonnage on consumption of fuel; and on locomotive lubricant-to-fuel oil consumption ratios.

3. Civil Air Transport.

The major gap is data on the extent of civil air operations other than commercial flights.

4. Water Transport.

Gaps include post-1952 data on tugs of the river fleet, with horsepower specifications; data on hours under way and at anchor for ocean and river vessels; data on consumption of fuel by the fishing

fleet; and bunkering data for non-Soviet ships, particularly at Constanta.

5. Agriculture.

Gaps include data on the extent of the area worked by machine; on the size and composition of the operating tractor and grain-combine parks; on the total annual rate of tractor repair; on the average rate of consumption, to include all tractor operations or the quantitative relationship between consumption by plowing and other tractor operations in the field; on the ratio between consumption of fuel in tractor field work and in nonfield work; and on the lubricant-to-fuel ratio.

6. Households.

Gaps include data on the extent of conversion to nonrefinery-product sources of light and heat (generator gas, liquefied petroleum gas, natural gas, electricity); on the effects of economic restrictions (kerosine rationing, raised prices, and the like) on consumption of kerosine; and on the percentage of fulfillment of the 1951-55 Plan for domestic consumption of kerosine.

7. Industry.

Gaps include data on the construction industry -- the quantity, types, condition, activity, and fuel rates of its equipment; on the increasing use of natural gas as fuel in petroleum refineries; on the rate of retirement of electric power plants burning diesel fuel and fuel oil, or their conversion to coal, lignite, and the like; and on the consumption of lubricants in major engineering plants.

APPENDIX C

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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1. Jordan, Constantin. The Romanian Oil Industry, New York, 1955, p. 334 and 340. U. Eval. RR 2.
2. CIA. ORR Project 25.675, The Output of Refined Petroleum Products in the European Satellites and Communist China (to be published). S/NOFORN.
3. CIA. CIA/RR RA (ORR Project 25.186), Civil Consumption of Petroleum Products in the USSR, 1945-55, 27 Sep 54, p. 33. S/US ONLY.
4. Jordan, op. cit. (1, above).
5. Conrad, G.J. Die Wirtschaft Rumaniens von 1945 bis 1952 (The Economy of Rumania from 1945 to 1952), nd, Berlin, Duncker and Humblot, p. 78. U. Eval. RR 2.

6. Ibid.
7. CIA. ORR Project 43.741, Agreed Basic Statistics on Railroad Transportation in the European Satellites (to be published). S/NOFORN.
8. Ibid.
9. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 34. S/US ONLY.
25X1A 10. International Railway Statistics, 1946, p. 104, Table 4-3, ICC Library. U. Eval. RR 2.
11. Ibid.
12. [redacted]
13. Jordan, op. cit. (1, above).
14. [redacted]
25X1A
15. Jordan, op. cit. (1, above), p. 275. U. Eval. RR 2.
16. The ABC World Airways Guide, Mar 55, p. 358-359, London. U. Eval. RR 2.
17. Ibid.
18. 25X1A Jordan, op. cit. (1, above).
19. [redacted]
20. Ibid.
21. CIA. CIA/RR RA (ORR Project 25.470), Petroleum Terminology, 31 May 55, p. 38. C.
22. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 35. S/US ONLY.
23. [redacted]
25X1A

24. NIS 22, Rumania, sec 33, Jan 51, p. 33-15. C.
25. Prigrada, Anthony. Danube Waterways, New York, National Committee for a Free Europe, Inc., 1953, p. 4 and 9. U. Eval. RR 2.
26. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 42-43. S/US ONLY.
27. Ibid., p. 43. S/US ONLY.
28. Ibid.
29. Ibid., p. 41. S/US ONLY.

25X1A

30. Ibid.
31. [redacted]
32. [redacted]
33. Lloyd's Register of Shipping, Register Book, 1951-52; 1953-54, London. U. Eval. RR 2.

25X1C

[redacted]

Lloyd's Register of Shipping, Appendix, 1954, London. U. Eval. RR 2.
NIS 22, Rumania, sec 36, Apr 52, p. 36-7. C.

34. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 42-43. S/US ONLY.
35. Ibid., p. 43. S/US ONLY.
36. Ibid.
37. NIS 22 (33, above).

25X1A

38. [redacted]

25X1A

39. NIS 22 (33, above), p. 36-9. C.
40. [redacted]
41. Encyclopaedia Britannica, vol 22, 1949, p. 344, Table VII. U.
42. [redacted]

25X1A

43. Puchkov, N.G. Dizel'nyye topliva (Diesel Fuels), Moscow, 1953, p. 185. U. Eval. RR 2.
44. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 55. S/US ONLY.
45. Ibid.
46. Ibid.
47. Ibid.
48. Ibid., p. 58. S/US ONLY.
49. Ibid.

50. Ibid., p. 59. S/US ONLY.
51. Ibid., p. 60. S/US ONLY.
52. Jordan, op. cit. (1, above), p. 340. U. Eval. RR 2.
53. State, Bucharest. Dsp 61, 12 Oct 54, The Distribution of Fuel Oil in Bucharest. S. Eval. RR 2.
54. Jordan, op. cit. (1, above), p. 340. U. Eval. RR 2.
55. Ibid., p. 280. U. Eval. RR 2.
56. Ibid.
57. Probleme Economice, Mar 48, Bucharest. U. Eval. RR 2.
58. [redacted]

25X1X7

STATSPEC

CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 65-79. S/US ONLY.
59. CIA. ORR Project 25.675, (2, above).
60. Jordan, op. cit. (1, above), p. 333. U. Eval. RR 2.
61. Ibid., p. 259, 332, 333. U. Eval. RR 2.
62. NIS 22, p. 62-30. S/US ONLY.
63. Ibid.
64. CIA. CIA/RR RA (ORR Project 25.470) (21, above), p. 46. C.
65. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 72. S/US ONLY.
66. Ibid., p. 74. S/US ONLY.
67. CIA. CIA/RR RA (ORR Project 25.470) (21, above), p. 46. C.
68. CIA. CIA/RR RA (ORR Project 25.186) (3, above), p. 74. S/US ONLY.
69. Ibid.
70. [redacted]
71. [redacted]

25X1A